PROSEA

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(3) Medicinal and poisonous plants 3

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No 12(3)

Medicinal and poisonous plants 3

R.H.M.J. Lemmens and N. Bunyapraphatsara
(Editors)

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Indigofera L.

Sp. pl. 2: 751 (1753) ; Gen. pl. ed. 5: 333 (1754).
LEGUMINOSAE
$x = 8$; *I. linnaei*, *I. tinctoria*: $2n = 16$

Origin and geographic distribution *Indigofera* consists of about 700 species, and is widely distributed in the tropics and subtropics of Africa, the Americas, Asia and Australia. Africa is richest in species, but the southern Himalaya region is also comparatively rich. Approximately 35 species occur naturally in South-East Asia, 16 of which are found in the Malesian region. Additionally, several species have been introduced in South-East Asia.

Uses *Indigofera* is used in traditional medicine in South-East Asia for various complaints, externally, e.g. to treat sores, ulcers and aphthae, as well as internally, e.g. to treat epilepsy and as a diuretic. Some *Indigofera* species are well-known dye plants throughout the world, especially *I. arrecta* Hochst. ex A. Rich. and *I. tinctoria* L., the leaves of which are also used in traditional medicine to treat epilepsy and nervous disorders, and to heal sores and ulcers. Several *Indigofera* species are used as a cover crop, green manure or fodder, e.g. *I. hirsuta* L. and *I. suffruticosa* Miller, both of which have medicinal applications: the leaves of the first are used to treat stomach complaints in the Philippines and Thailand, the roots of the second to treat stomach-ache and diarrhoea, the leaves against fever and the juice against diarrhoea in Malaysia. Seeds are used occasionally as a famine food, including those of *I. linifolia* and *I. linnaei*.

In Taiwan the roots of *I. zollingeriana* Miq. are used to treat stomach-ache and snakebites. In Burma (Myanmar) the roots of *I. cassioides* Rottler ex DC. (synonym: *I. pulchella* Roxb.) are applied to treat cough.

Properties An ethanol extract from the leaves of *I. oblongifolia* showed in-vitro antibacterial activity against *Enterococcus faecalis*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Small proteins or peptides in the leaves of *I. oblongifolia* show considerable in-vitro antibacterial and antifungal activity. These compounds probably play a role in the defence mechanism of the plant.

An extract of the above ground parts of *I. tinctoria* shows hypoglycaemic and central nervous system-depressant effects in rats, and potentiates pentobarbital sodium-induced sleep in mice. An ethanol extract possesses protective effects against carbon tetrachloride-induced liver damage in rabbits, rats and mice, as confirmed by histopathological studies.

Pharmacological research on *I. arrecta* supports its traditional use in Ghana, where an aqueous extract of leaves from immature shoots is administered orally to patients with diabetes mellitus. This extract prevented the development of hyperglycaemia in genetically obese diabetic mice. In tests with rats, an intraperitoneal administration of a hot water extract of dried leaves decreased the plasma glucose levels of fasting normoglycaemic rats, but did not prevent the rise in plasma glucose after an oral glucose load. It was suggested that the extract is insulinotropic and may require functional β-cells to be active. The extract was devoid of acute and subchronic toxic effects in tests with mice. Clinical test data suggest that the plant may not have overt toxic reactions in humans but could affect the immune status of users. A medicine based on *I. arrecta* for the management of peptic ulcer has been patented.

Many *Indigofera* species contain toxic compounds. The toxic effects of *I. linnaei* may well be attributed to the presence of nitropropanoyl esters that upon hydrolysis yield 3-nitropropanoic acid. This compound inhibits succiniate dehydrogenase and other essential respiratory enzymes. Several flavonoids have been isolated from *Indigofera*, including *I. linifolia*.

Botany Annual or perennial herbs or shrubs, with a taproot; branches spreading or ascending; indumentum consisting of 2-branched hairs. Leaves alternate, imparipinnate, sometimes trifoliolate or unifoliolate; stipules usually persistent. Inflorescence an axillary raceme, bracteate. Flowers bisexual, pedicellate; calyx campanulate, 5-toothed; corolla papilionaceous, standard without appendages, usually pubescent outside, wings usually with an auricle at base, keel with auricles at base and with lateral pockets; stamens 10, 9 connate and 1 free, all fertile, alternatingly shorter and longer; ovary superior, sessile, 1-celled, style curved upwards. Fruit a linear to globose pod, 1–20-seeded, dehiscent or not. Seeds globose to ellipsoid, cylindrical or quadrangular. Seedling with epigeal germination; cotyledons thick, short-lasting.

In Java flowering and fruiting of *I. linifolia* is limited to March–June, whereas *I. linnaei* and *I. oblongifolia* can be found flowering and fruiting throughout the year. *I. linifolia* and *I. linnaei* both have nodulating ability.

The large number of species makes a worldwide

taxonomical study of *Indigofera* a daunting task. In many regions the genus has been incompletely studied, and in regions where a taxonomic revision has been accomplished, comparisons with other regions have usually not been done.

Ecology Most *Indigofera* species occur in open locations, such as grassland, roadsides and open deciduous forest, in the lowland. In South-East Asia several species are bound to monsoon areas. *I. linifolia* prefers an extremely dry monsoon climate.

Management Propagation of the *Indigofera* species treated here is by seed. Soaking for 5 minutes in concentrated H_2SO_4 increased the germination rate of *I. oblongifolia* seeds from 10% to 90%, whereas gibberellic acid was ineffective. In *I. linifolia* pretreatment with KNO_3, 1-naphthalene acetic acid (NAA) and 3-indole acetic acid (IAA) proved to be effective in breaking seed dormancy, whereas for *I. linnaei* this did not work. Thiourea proved to be effective in both species.

Genetic resources In view of their wide distribution and presence in dry open habitats, the *Indigofera* species treated here do not appear to be threatened by genetic erosion.

Prospects Several fractions of *Indigofera* showed various interesting pharmacological effects, both in vitro and in vivo. Further research is needed to fully evaluate these preliminary results for future applications.

Literature 198, 239, 542, 688, 731, 870.

Selection of species

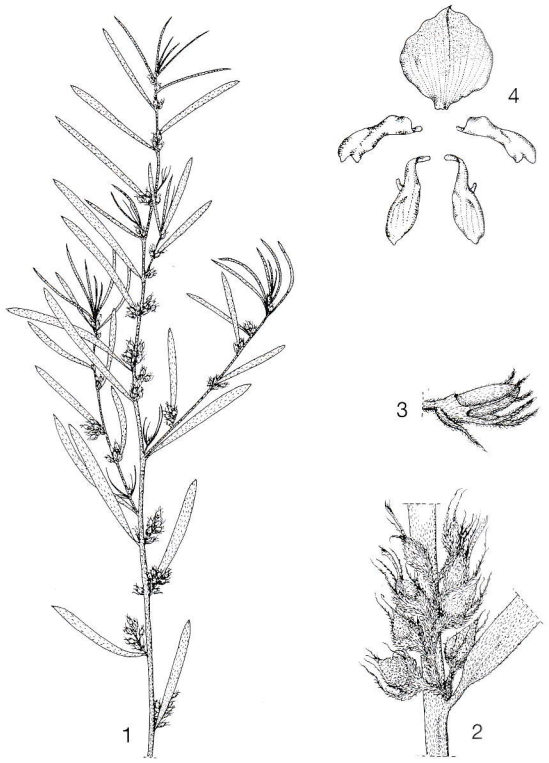
Indigofera linifolia (L.f.) Retz.

Obs. 4: 29 (1786).

Vernacular names Indonesia: rumba mutong (Sumba), rhema mon-hoi (Flores). Vietnam: ch[af]m l[as] lanh.

Distribution From Sudan and Ethiopia eastward to Indo-China, China, the Ryukyu Islands, Taiwan and Thailand, and throughout the drier parts of South-East Asia (in Malesia in eastern Java, the Lesser Sunda Islands, the Philippines (Luzon) and New Guinea), southward to northern Australia.

Uses In India the whole plant is given as a febrifuge. In combination with *Euphorbia thymifolia* L. it is used to treat amenorrhoea. It is further credited with vermifuge properties. The leaves are used to treat cuts and wounds. *I. linifolia* is recommended as a fodder for goats in very dry areas.



Indigofera linifolia (L.f.) Retz. – 1, flowering and fruiting twig; 2, old inflorescence; 3, flower bud; 4, corolla.

Observations An annual or perennial, prostrate or erect herb or shrublet up to100 cm tall; leaves unifoliate, elliptical to linear, 0.5–4 cm × 0.2–0.4 cm, base cuneate, apex acuminate; inflorescence up to 15 mm long; calyx 3–4 mm long, standard elliptical, up to 5 mm long, pale with a red base, wings and keel slightly shorter, bright red; fruit globose, beaked, 2–3 mm × 1.5 mm, densely appressed grey-hairy, 1-seeded, endocarp not blotched; seed rounded, laterally flattened, 1.2 mm × 1 mm. *I. linifolia* is found on very arid localities on grassland, cropped land, roadsides, beaches and grassy deciduous forest from sea-level up to 750 m altitude.

Selected sources 35, 62, 121, 181, 198, 250, 334, 965.

Indigofera linnaei Ali

Bot. Notis. 3: 549 (1958).

Synonyms *Hedysarum prostratum* Burm.f. (1768), *Indigofera enneaphylla* L. (1771), *Indigofera prostrata* (L.) Domin (1926).

Vernacular names Indonesia: dedekan, trus-

pala (Javanese), met gamet (Madurese). Vietnam: ch[af]m linne.

Distribution From Pakistan and India eastward to Indo-China, Thailand, throughout the drier parts of Malesia (eastern Java, the Lesser Sunda Islands, Sulawesi and New Guinea) to Australia.

Uses In Java the plant is used against aphthae and as a diuretic. In India the plant juice is used as an antiscorbutic, diuretic and alterative. Boiled with oil, the aboveground parts are applied to burns. A decoction is given to treat epilepsy and insanity. *I. linnaei* is recommended as a green manure. In pastures it is a fodder for cattle, but it is poisonous to horses.

Observations An annual or perennial herb or shrublet up to 90 cm tall; leaflets 3–11, alternate, ovate to narrowly ovate, the terminal one 0.5–1.5 cm × 0.3–0.5 cm, the lateral ones 0.3–1.3 cm × 0.2–0.4 cm, base cuneate, apex obtuse to truncate; inflorescence 0.5–2.5 cm long; calyx up to 4 mm long, standard broadly ovate to orbicular, 3–5 mm long, bright red with a pale base, wings and keel slightly shorter, orange-red; fruit spreading, globose, slightly beaked, 3–8 mm × 1.5–2 mm, hairy, (1–)2–3-seeded, endocarp not blotched; seeds rounded, 1 mm × 1 mm. *I. linnaei* is found in grassland, along roadsides and on dykes from sea-level up to 400 m altitude.

Selected sources 35, 62, 121, 181, 198, 250, 334, 965.

Indigofera oblongifolia Forssk.

Fl. Aegypt.-Arab.: 137 (1775).

Synonyms *Indigofera paucifolia* Delile (1813).

Vernacular names Indonesia: tom (Javanese).

Distribution From tropical Africa to northern India and Sri Lanka, and Java (probably introduced).

Uses The plant is reported as an antisyphilitic. In the traditional Ayurvedic system the root is considered cooling, improving the appetite and a remedy for rheumatism. All parts of the plant are considered useful in enlargements of the liver and spleen. The leaf is a vulnerary, and it is used to treat dysentery. In Yemen the leaves are traditionally used for urinary infections, urolithiasis and skin infections. In East Africa the root is boiled with milk and used as purgative; a decoction of the stem is applied as a gargle. In India *I. oblongifolia* is planted as a green manure in wet lands, and recommended as a fodder for sheep.

Observations A small shrub up to 180 cm tall; leaflets 1–5, alternate, sometimes almost opposite, obovate to narrowly obovate, the terminal one 1.6–4 cm × 0.5–1 cm, the lateral ones 1.2 cm × 0.4–0.8 cm; inflorescence 1.5–8 cm long; calyx up to 2 mm long, standard orbicular, 4 mm long, greenish-yellow with red streaks, wings and keel shorter and elliptical; fruit slightly curved, constricted between the seeds, rounded in cross-section, 10–20 mm × 2 mm, hairy, (3–)7–9-seeded, endocarp blotched; seeds broadly elliptical, 2 mm × 1 mm. *I. oblongifolia* occurs in grassland and along roadsides, especially along the coast below 100 m altitude.

Selected sources 59, 62, 121, 181, 198, 944.

Sudibyo Supardi & Hurip Pratomo

Indorouchera griffithiana (Planchon) Hallier f.

Beih. Bot. Centralbl. 39: 50 (1923).

LINACEAE

$2n$ = unknown

Synonyms *Roucheria griffithiana* Planchon (1847).

Vernacular names Brunei: akar katjap. Indonesia: akar tanduk, takkolan (Malay), wa bakar (Iban). Malaysia: akar garam-garam, akar serawan (Peninsular), dingkai (Sabah).

Origin and geographic distribution *I. griffithiana* occurs in the Nicobar Islands, southern Thailand, Peninsular Malaysia, Sumatra, western Java (rare) and Borneo.

Uses In Peninsular Malaysia, the leaves and flowers are applied to the head to treat headache, and a decoction of the roots is used against bowel complaints. A decoction of the roots and stem is applied to treat fever, e.g. in case of malaria. The bark and sap are used as a blow-pipe dart poison. The fruits are edible, and have a tomato-like flavour. When a liana is cut in the forest, fresh water can be obtained from it. The wood is sometimes used for small objects such as knife handles.

Properties According to old records, lupeol and saponin are present in the bark. More recent investigations gave contradictory results: one sample showed the presence of terpenes in the leaves, but negative results for alkaloids and saponins in leaves and stems, whereas another sample showed very high contents of alkaloids and saponin in the stem and a low content of these compounds in the leaves.

Botany A large liana up to 30 m long, with stem

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Prosea, short for 'Plant Resources of South-East Asia', is an international programme focused on South-East Asia. Its purpose is to make available the wealth of dispersed knowledge on plant resources for education, extension, research and industry through a computerized data bank and an illustrated multivolume handbook. A thorough knowledge of plant resources is essential for human life and plays a key role in ecologically balanced land-use systems. Extensive information on the plants growing in the region is needed to enable the plant resources of each country to be used optimally. A large international team of experts is preparing the texts on particular species or genera, which are being published in commodity groups. All taxa are treated in a similar manner with details on uses, botany, ecology, agronomy or silviculture, genetic resources, breeding, prospects and literature.

This third volume completes the PROSEA trilogy on the medicinal and poisonous plants of South-East Asia, and brings the total number of papers in the 3 volumes to 548, and of species treated to 1290. The present volume includes many lesser-known species, for which in general little information on the phytochemistry and pharmacology is available compared to those treated in the first (1999) and second (2001) ones. Although presently of little importance, these plant resources may have potential for use in herbal drugs or for the isolation of bioactive compounds. The up-to-date information contained in this volume is, wherever applicable, supplemented by notes on possibilities for research and expectations for the future. Some genera/species that have recently attracted attention because of interesting pharmacological properties are included, e.g. *Butea*, *Calophyllum*, *Galbulimima belgraveana*, *Gynura* and *Morinda*. The alphabetical treatment of genera and species in this volume comprises 285 papers, half of which are supplied with an illustration. The approximately 540 species show a large variation in habit, from small herbs to large trees, and in ecology, from rain forest to habitats strongly influenced by man. A short introduction deals particularly with conservation aspects of medicinal plants, being supplementary to the general introduction in the first volume on medicinal and poisonous plants. A glossary, a list of medicinal and poisonous plants with other primary use, and several indices are included.

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